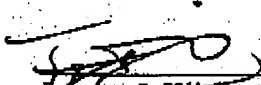


USSN 09/457,434  
Atty. Docket No. HEN-9910

If applicants have misunderstood the Examiner's reason for this Notice of Non-Compliant Amendment, or if the Examiner requires additional information, he is encouraged to contact applicants' attorney at the below listed telephone number or facsimile number.

Respectfully submitted:

Date: 3-06-03

  
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**REPLACEMENT PAGES 8 AND 9 OF THE SPECIFICATION ACCOMPANYING RESPONSE TO  
OFFICE ACTION FOR USSN 09/457,434**

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mean that the percents are based on the weight of the support. For example, if the support were to weigh 100 g. then 20 wt.% Group VIII metal would mean that 20 g. of Group VIII metal was on the support. Typical hydrotreating temperatures range from about 100°C to about 400°C with pressures from about 50 psig to about 3,000 psig, preferably from about 50 psig to about 2,500 psig.

A combined liquid phase and vapor phase product stream exit reaction vessel R1 via line 16 and into separation zone S wherein a liquid phase product stream is separated from a vapor phase product stream. The liquid phase product stream will typically be one that has components boiling in the range from about 150°C to about 650°C, but will not have a boiling range greater than the feedstream. The vapor phase product stream is collected overhead via line 18.

The liquid reaction product from separation zone S is passed to reaction vessel R2 via line 20 and is passed downwardly through the reaction zones 22a and 22b of reaction stage R2. Prior to being passed downwardly through reaction stage R2, said liquid reaction product stream can first be contacted in a stripping zone to remove entrapped vapor components from the liquid stream. For example, as the liquid product stream flows through the stripping zone, it is contacted by upflowing hydrogen-containing treat gas under conditions effective for transferring at least a portion of the feed impurities in the vapor into the liquid. The contacting means comprises any known vapor- liquid contacting means, such as rashig rings, berl saddles, wire mesh, ribbon, open honeycomb, gas-liquid contacting trays, such as bubble cap trays and other devices, etc.

Fresh hydrogen-containing treat gas is introduced into reaction stage R2 via line 24 and is passed in an upward direction counter to the flow of liquid reaction product. The introduction of clean treat gas (gas substantially free of H<sub>2</sub>S

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and  $\text{NH}_3$ ) allows reaction stage R2 to be operated more efficiently owing to a reduction in the activity suppression effects on the catalyst exerted by  $\text{H}_2\text{S}$  and  $\text{NH}_3$  and an increase in  $\text{H}_2$  partial pressure. This type of two stage operation is particularly attractive for very deep removal of sulfur and nitrogen or when a more sensitive catalyst (i.e., hydrocracking, aromatic saturation, etc.) is used in the second reactor. Another advantage of the present invention is that the treat gas rate is relatively low compared with more conventional processes. The use of relatively low treat gas rates is primarily due to the use of previously hydrotreated distillate feedstocks. Further efficiencies are gained by not requiring recycle of treat gas.

The liquid/vapor separation step (S) may be a simple flash or may involve the addition of stripping steam or gas to improve the removal of  $\text{H}_2\text{S}$  and  $\text{NH}_3$ . The liquid stream and treat gas are passed countercurrent to each other through one or more catalyst beds, or reaction zones, 22a and 22b. The resulting liquid product stream exits reaction stage R2 via line 26, and a hydrogen-containing vapor product stream exits reaction stage R2 and is cascaded to reaction stage R1. Reaction stage R2 also contains non reaction zones 23a and 23b following each reaction zones. The catalyst in this second reaction stage is an aromatic saturation catalyst.

The figure also shows several options. For example, lines 30 and 32 can carry kerosene which can be used as a quench fluid. Also, a unsaturated feedstock can also be introduced into the first reaction stage via line 28. The degree of unsaturation can be up to about 50 wt.%.

The reaction stages used in the practice of the present invention are operated at suitable temperatures and pressures for the desired reaction. For example, typical hydroprocessing temperatures will range from about  $40^\circ\text{C}$  to about